REMARKS

Applicants acknowledge that the Office Action dated May 2, 2007 has been made final. Accordingly, a Request for Continued Examination has been submitted herewith, and further consideration of this application in light of the amendments set forth above and the following comments is respectfully requested.

Claims 1, 2, 10-12 have been rejected under 35 U.S.C. §103(a) as unpatentable over Donaghue et al (U.S. Patent No. 4,369,689) in view of Hiorth (U.S. Patent No. 4,191,480) and Halliday et al (U.S. Patent No. 4,966,077). In addition, Claim 3 has been rejected as unpatentable over the same three references and further in view of AECI Limited (UK Patent Application GB 2 205 386), while Claims 4 and 5 have been rejected as unpatentable over the same three references, and further in view of Pyle (U.S. Patent No. 4,503,994). However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims which remain of record in this application distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to a method and apparatus for filling ordnance with explosive material (*e.g.*, PBX), which usually involves the mixing of two materials, including an explosive material (referred to as a pre-mix) and a hardener, which are mixed together immediately prior to use in filling the chosen

ordnance. One problem associated with this process, however, is that, after mixing with the hardener, the PBX composition has a limited shelf life before it cures (that is, hardens). Accordingly, once the hardener and the pre-mix have been combined, the amount of time which can be taken in order to fill the ordnance is limited. If it hardens before the process is completed, numerous problems occur with PBX having solidified within the pipework, etc.

The present invention addresses and resolves this problem by providing a process in which a pre-mix comprising an explosive material and a hardener material are conveyed to a static mixing device via separate pipes. As they enter the mixing device, the two materials are forced through a number of static mixing blades, thereby combining them. Thereafter, the mixed composition is conveyed directly to the ordnance which are to be filled.

According to a feature of the invention, the flow of pre-mix material toward and into the static mixer via a pipe 14 (Figure 1) is controlled using a hydraulic cylinder 6 and ram assembly 8 (as illustrated in the Figure) to apply pressure to the pre-mix material within a reservoir. Under the control of a hydraulic cylinder controller 10, the hydraulic cylinder/ram assembly 6, 8 therefore controls the flow of pre-mix material 2 through the pipe 14, into the static mixer 26. The hardener material 16, on the other hand, is conveyed from a tank 18 to the static mixer via a pump 22 and pipe 24.

With this arrangement, the pre-mix material 2 and the hardener 16 are combined only at the point at which they enter the static mixer, after which the combined composition immediately flows into the ordnance which are to be filled (38). Moreover, the rate at which the PBX material flows into the ordnance from the static mixer is controlled by the fill level controller 42 and the hydraulic cylinder controller 10 by controlling the application of pressure to the pre-mix material.

The recitation that the flow of explosive pre-mix material is generated by using a hydraulic cylinder and ram assembly to apply pressure to the pre-mix within the reservoir itself is significant in that it enhances the safety of the overall operation. That is, as indicated at paragraph [0031], certain types of apparatus for causing a flow cannot safely be used to pump such a material. In particular, the specification states at [0031] that "the hydraulic cylinder 6 and ram 8 assembly is far safer than using displacement pumps to pump the pre-mix explosive material to the static mixer 26. It is also to be noted that the pre-mix explosive material is not pumped to the static mixer as this may be too dangerous".

In the foregoing amendment, the language of Claim 1 has been revised to make it clear that the pre-mix which is contained in a first reservoir in fact comprises "an explosive material in flowable form". Support for the proposition that the pre-mix is in fact an "explosive" is found in the specification in

paragraphs [0002], [0003] and [0031] as well as to the numerous references to PBX. Paragraph [0002], for example, refers to an "explosive mixture (pre-mix)". The role of the hardener, on the other hand, is to cause the explosive material to cure or harden.

In addition, the final paragraph of Claim 1 has been amended to recite that the hydraulic cylinder and ram assembly is coupled to apply controlled pressure "to the pre-mix contained in said first reservoir". This feature of the invention is significant for the reason noted in paragraph [0031] that in view of the explosive nature of the pre-mix, it is far safer than pumping such materials, for example, by means of a piston pump, such as utilized in the prior art.

The foregoing features of the invention are not taught or suggested by the cited references. In Donaghue et al, for example, granular nitrate particles are stored in a hopper from which they flow into a cylindrical casing 4 that contains a motor-driven auger 2. Inside the cylindrical casing 4, the particles are dispersed downward over the top of a cone shaped deflector plate 5 which causes the stream of solid particles to assume a hollow cylindrical configuration. The liquid materials are injected into the cylindrical casing by a nozzle 6, which is situated within the cylindrical stream of solid particles. As the particles fall they are coated with a liquid material, so that the mass that is collected at the bottom of the casing is an even dispersing of ammonium nitrate particles in a mix of polyurethane precursor. (See Column 4, lines 32-58.)

The Hiorth reference, on the other hand, has been cited as disclosing that it is known to use static mixers for mixing explosive materials. Hiorth, however, fails to teach or suggest the use of a hydraulic cylinder to apply pressure to a pre-mix comprising an explosive material, within a reservoir as recited in Claim 1.

Finally, the Halliday et al reference is cited as teaching that it is known to provide a hydraulic cylinder and ram assembly that is coupled to apply pressure to a pre-mix explosive material upstream of a static mixer in order to control the rate of finished material that exits the mixer. In support of this proposition, the Office Action refers to Column 1, lines 40-65; Column 3, line 59, Column 4, line 4 and Column 5, lines 29-69.

Applicants note, however, that rather than using a hydraulic cylinder and ram assembly to apply pressure to an explosive material in a reservoir, Halliday et al uses two pumps 12 and 16, both of which are reciprocating piston and cylinder pumps, in order to pump the respective constituents through lines 24-54, where they are mixed prior to being forced through a line 70 and a nozzle 72. The two pumps in questioned are discussed in the specification starting at Column 3, line 54. In particular, at Column 3, lines 59 and 60, the specification notes that the pump 12 "is of a reciprocal piston cylinder type...". Similarly, as noted at Column 4, lines 26-29, the dosing pump "has a cylinder 50 within which a piston [not shown] is reciprocable". Accordingly, Applicants respectfully submit that Halliday et al does not teach or suggest the use of a hydraulic

cylinder and ram assembly "to apply control pressure to an explosive pre-mix" that is "contained in said first reservoir". As noted previously, this feature of the invention is significant because it achieves an additional margin of safety which is not found in any of the references.

Accordingly, Applicants respectfully submit that Claim 1 as amended distinguishes over the cited prior art references. Claim 12 is a method claim which contains limitations which are parallel to those discussed above with regard to Claim 1, and accordingly, Claim 12 is believed to be allowable for the same reasons.

UK Patent GB 2 205 386 A is cited only as disclosing an explosive mixer that utilizes a static mixer and channels the output into cartridge shells or other ordnance, while Pyle is said to disclose a fiber optic level liquid sensing device. Accordingly, Applicants respectfully submit that those features discussed above, which are missing in Donaghue et al, Hiorth and Halliday et al are not taught or suggested by either of the latter references.

Finally, new Claims 13 and 14 have been added, which depend, respectively from Claims 1 and 12, and contain corresponding limitations. Claim 13, for example, recites that the mixing apparatus according to Claim 1 further comprises a level controller for sensing whether ordnance requires filling and for

generating a corresponding signal and a fill to level controller for initiating the flow of the pre-mix in response to such signal.

In the outstanding Office Action, Claims 4 and 5, which include similar limitations, were rejected based on the combination of Donaghue et al, Hiorth Halliday et al and Pyle. The Office Action indicates that Pyle discloses a fiber optic liquid level sensing device that will shut off the flow of fluid when it reaches a certain height. Applicants respectfully submit, however, that, as shown in Figure 1, the Pyle apparatus fills the container until the tip 82 of the nozzle 10 is submerged in fluid. However, the position of the nozzle 10 is determined by the manner in which the human operator holds it, and there is no disclosure which insures that the human operator holds the nozzle 10 at any particular level, unless the nozzle is submerged. It is in fact the human operator determines whether the fuel flows or not, since squeezing lever 29 causes fuel to flow, while releasing it arrests the flow. Accordingly, Applicants respectfully submit that Pyle does not disclose a "fill to level controller".

The Office Action at item 4 indicates that it would be obvious to combine the teaching of Pyle with those of Donaghue et al, Hiorth and Halliday et al in order to determine when the bore hole or ordnance has been filled to the top. Applicants respectfully submit, however, that it would not be obvious to combine Pyle with any of the Donaghue et al, Hiorth or Halliday et al references, because of an incompatibility between the sensor of Pyle and the final explosive mixture

in each of the other references. That is, the latter all disclose final explosive mixtures which harden upon mixing. (Donaghue et al Column 6, lines 44-45; Hiorth Column 6, lines 54-55; and Halliday et al Column 7, lines 39-42.) In hardening, the mixture tends to become adhesive. Thus, if the nozzle of Pyle were used with one of the final explosive mixtures of Donaghue et al, Hiorth or Halliday et al, then because the Pyle sensor relies on physical contact with the fluid, it would become caked in the final explosive mixture and need to be cleaned or replaced after each and every fill. A person skilled in the art according would not undertake such a combination.

Finally, Claims 13 and 14 depend, respectively from Claims 1 and 12, and are therefore also allowable for the reasons noted above regarding the latter claims.

In light of the foregoing remarks, this application should be in consideration for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and

please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038665.55361US).

Respectfully submitted,

Gary R. Edwards
Registration No. 31,824

CROWELL & MORING LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844
GRE:kms
4247420_1